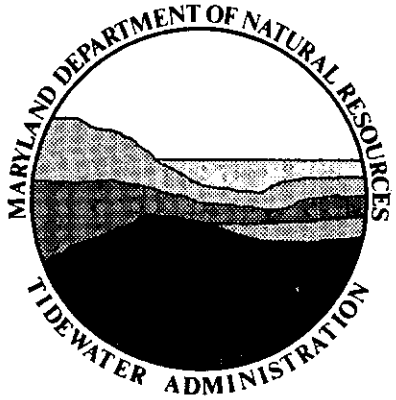
PPRP

Maryland Power Plants and the Environment

A review of the impacts of power plants and transmission lines on Maryland's natural resources

March 1993

MARYLAND POWER PLANT RESEARCH PROGRAM



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As Secretary of the Maryland Department of Natural Resources, I am convinced that public support of DNR's mission is essential if we are to restore the State's once bountiful natural resources, especially the Chesapeake Bay, to the level which earned the title "America in Miniature." The information in this publication is designed to increase your understanding of our program and of Maryland's natural resources.

Torrey C. Brown, M.D.

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Background on Electric Power Generation in Maryland

Introduction

Power plants in Maryland, like all industrial facilities across the United States, affect the environment in various ways. For example, power plants can emit air pollutants that affect local air quality and can contribute to worldwide problems like acid rain and global warming. Some power plants in Maryland draw in large volumes of water from the Chesapeake Bay and local rivers, use it, and then discharge the wastewater, potentially affecting local fish and shellfish stocks. Ash from Maryland's coal-fired power plants is collected and landfilled at different places in the state. More and more transmission lines are being built across the state as the demand for electricity grows.

All of these activities affect the local environment to some degree. And, even though we acknowledge that we need power plants and transmission lines, we still need to be concerned with how power plants affect the environment. What impacts *do* power plants have on the environment? Are the impacts significant? What are the costs to minimize the impacts? Who makes decisions regarding power plants and their potential impacts?

The Maryland Department of Natural Resources **Power Plant Research Program (PPRP)** investigates how power plants impact Maryland's air, water, and land resources. Later in this introduction, the development and the role of PPRP are described further. As part of its charge, PPRP prepares this **Cumulative Environmental Impact Report (CEIR)** every other year to summarize the information available on impacts to Maryland's environment from power generation and distribution.

This is the eighth CEIR published by PPRP, and it is much different from previous years' reports. In past CEIRs, we presented detailed results of a variety of specific environmental studies that evaluated impacts to Maryland's air, water, land, and cultural resources. That important line of research continues and is summarized in Section 2. (Detailed information that was used to develop Section 2 is included in a companion volume to this report.) In addition to these issues that have always been addressed in the CEIR, a number of trends and developments in environmental, regulatory, and energy policy areas affect how power is generated nationally and in Maryland. These include concern for the Chesapeake Bay, nuclear power plant licensing, the role of non-utility generators, and utility conservation and demand management projects. PPRP has been investigating these and other issues over the years, and we report on them in Section 3. Finally, beyond reviewing current environmental impact issues, we also present an overview of emerging power plant and related environmental impact issues, such as global warming and electric and magnetic fields, in Section 4 of this report.

The Role of PPRP

The Power Plant Siting Program, precursor to the current PPRP, was created by the Maryland legislature in 1971 as a result of extensive public debate regarding the potential effects on the Chesapeake Bay from the Calvert Cliffs Nuclear Power Plant. Calvert Cliffs was a source of concern because the plant uses a once-through cooling system that withdraws 3,500 million gallons of water per day from the Bay and discharges the water back to the Bay with a temperature elevation of about 12°F. The magnitude and diversity of potential environmental impacts that came to light during the licensing of Calvert Cliffs prompted the creation of PPRP to ensure a complete evaluation and resolution of issues before future decisions were made regarding whether and where to build other generating facilities.

Today, PPRP continues to conduct research on power plant impacts to the Chesapeake Bay, one of Maryland's greatest natural resources. In addition to surface water concerns, PPRP's evaluations consider impacts to Maryland's air, land, and human resources as well. All of these areas are examined in PPRP's review of proposed power facilities, including new plants, expansions of existing plants, and transmission lines. To construct any of these facilities, a company must obtain a **Certificate of Public Convenience and Necessity (CPCN)** from the Maryland Public Service Commission (PSC). As part of this licensing process, applicants must address a full range of environmental, engineering, socio-economic, planning, need, and cost issues.

PPRP is responsible for managing the **consolidated review** of CPCN applications. This is the only process within the state regulatory framework that allows a comprehensive review of all electric power issues. The goal of the consolidated review is to ensure that adequate electricity is provided to Maryland users at a reasonable cost while minimizing the impacts on the environment.

As part of the review, PPRP coordinates the involvement of the Departments of Natural Resources, Environment, Agriculture, Economic and Employment Development, and Transportation; the Office of State Planning; and the Maryland Energy Administration. PPRP usually represents those agencies in the CPCN hearing process conducted by the PSC. The general goals of the comprehensive licensing review are to:

- *Assess the suitability of sites in the state that utilities identify as potential locations for construction or modification of power plants or transmission lines.*
- *Evaluate potential environmental impacts of proposed power plant facilities and transmission lines on air, surface water, ground water, terrestrial, and cultural and historic resources.*
- *Analyze the need for new power plants or transmission facilities, taking into account cost and energy conservation alternatives for reducing energy demand.*
- *Coordinate the development of recommendations, using the evaluations outlined above, that become conditions of the CPCN to ensure that impacts are minimized or mitigated.*

As part of the CPCN process, the PSC holds a series of public hearings. Based on the background information presented by the applicant, the state agency evalua-

tions coordinated by PPRP, and input from local governments, environmental groups, and citizens' groups, the PSC decides whether to grant a CPCN. If the license is granted, the PSC also determines conditions it will place on the license to ensure that the new or modified facility is operated in an environmentally acceptable way.

Another important function of PPRP is to assist the PSC in evaluating the utilities' **long-range plans** for meeting electricity demand. Two issues are involved in evaluating such plans: 1) the utility's load forecast, which determines the amount of additional capacity resources needed; and 2) the economic assessment of alternative plans for meeting these needs in the most cost-effective way. With respect to utilities' load forecasts, PPRP sponsors an independently prepared load forecast for each major Maryland utility. These forecast studies are prepared periodically and are used to evaluate CPCN applications before the PSC. Utilities' expansion plans also include economic studies that compare the cost of various alternatives. PPRP has actively participated in this process, evaluating those studies and in many instances recommending modifications. Through its research and informal interaction with the state's utilities, PPRP has been working to expand the role that load management and conservation programs play in meeting customer power demands in a reliable and cost-effective manner.

PPRP's activities cover a wide spectrum of power plant issues. There is also considerable variety in the types of power plants operating in Maryland; each facility has its unique setting and characteristics. The rest of this section describes the companies that operate power plants in Maryland, and introduces the major types of power generating facilities in use in the state.

Who Supplies Electricity in Maryland?

Electricity in Maryland is supplied principally by **investor-owned utilities (IOUs)**. IOUs are large, vertically integrated firms that generate electricity, transport it over high-voltage transmission lines to population centers, and then distribute it to consumers. Three other types of companies that supply electric power in Maryland are:

- *municipal utilities,*
- *rural electric cooperatives, and*
- *non-utility generators (NUGs).*

A municipal utility, associated with a specific town or city, owns the local distribution facilities, generates electricity itself or buys

How is Electricity Generated in Maryland?

In Maryland, three types of generation technologies provide the bulk of the electricity in the state:

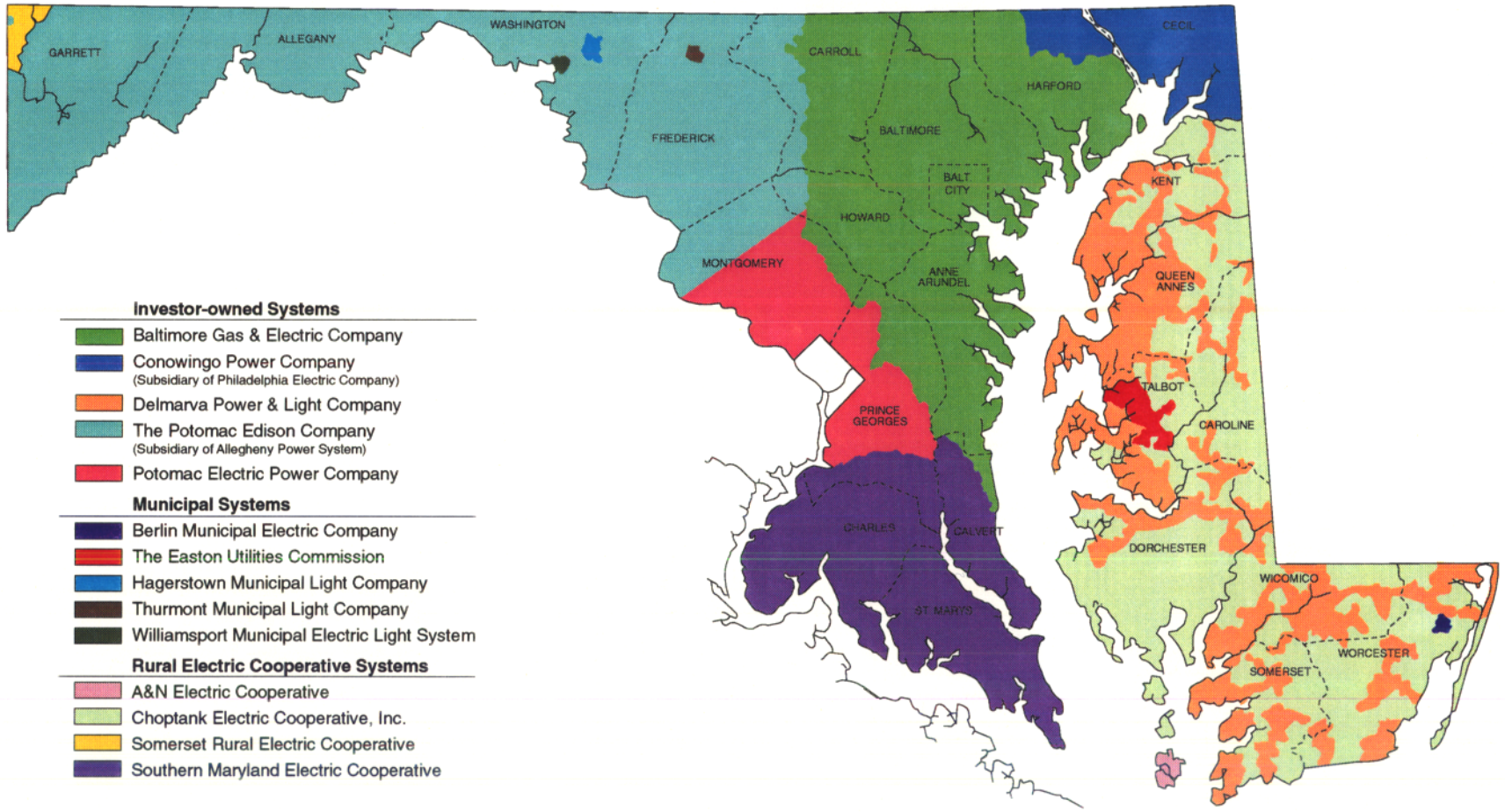
- *steam turbines (both fossil fuel-fired and nuclear-powered boilers),*
- *combustion turbines, and*
- *hydroelectric units.*

Steam turbine power plants are the most common generation technology in Maryland. A steam turbine is an enclosed rotary device in which the energy of high-temperature, high-pressure steam is converted to mechanical energy by passing through rows of radial blades attached to a central rotor. The rotational motion induced by the steam is used to generate electricity. Steam turbine plants in Maryland use either fossil fuels (coal, oil, or natural gas) or nuclear fission to generate steam. Steam electric stations in Maryland burn mostly pulverized coal, reflecting the national trend during the 1970s and 1980s toward coal and away from oil as the primary fuel.

Combustion turbines are the second most common power generation technology in use in Maryland. Combustion turbines use compressors to draw air from the atmosphere and pressurize it. The compressed air is then directed to the combustor where it is mixed with fuel (oil or natural gas) and ignited. The energy of the combustion product is converted to mechanical energy by expansion in a turbine. This mechanical energy is used to drive generators that produce electricity. Combustion turbines in the state are primarily used to provide peak power, that is, to help meet short-term demands for electricity when demand is highest.

Hydroelectric power, the third major generation technology in Maryland, uses the energy of moving water to produce electricity. Potential energy in the form of stored water behind a dam is converted to kinetic energy when drawn by gravity through the dam's conduits. In this system, flowing water pushes against turbine blades to drive generators and produce electricity.

Figure 1-1
Utility Service Areas in Maryland



wholesale power from another utility, and distributes it to local citizens. Rural cooperatives, which were established during the 1930s to provide electricity to rural America, serve larger areas in less populated portions of the state and obtain most of their funding from the federal Rural Electrification Administration. NUGs generate electric power and sell it wholesale to utilities or, in some cases, consume it on-site.

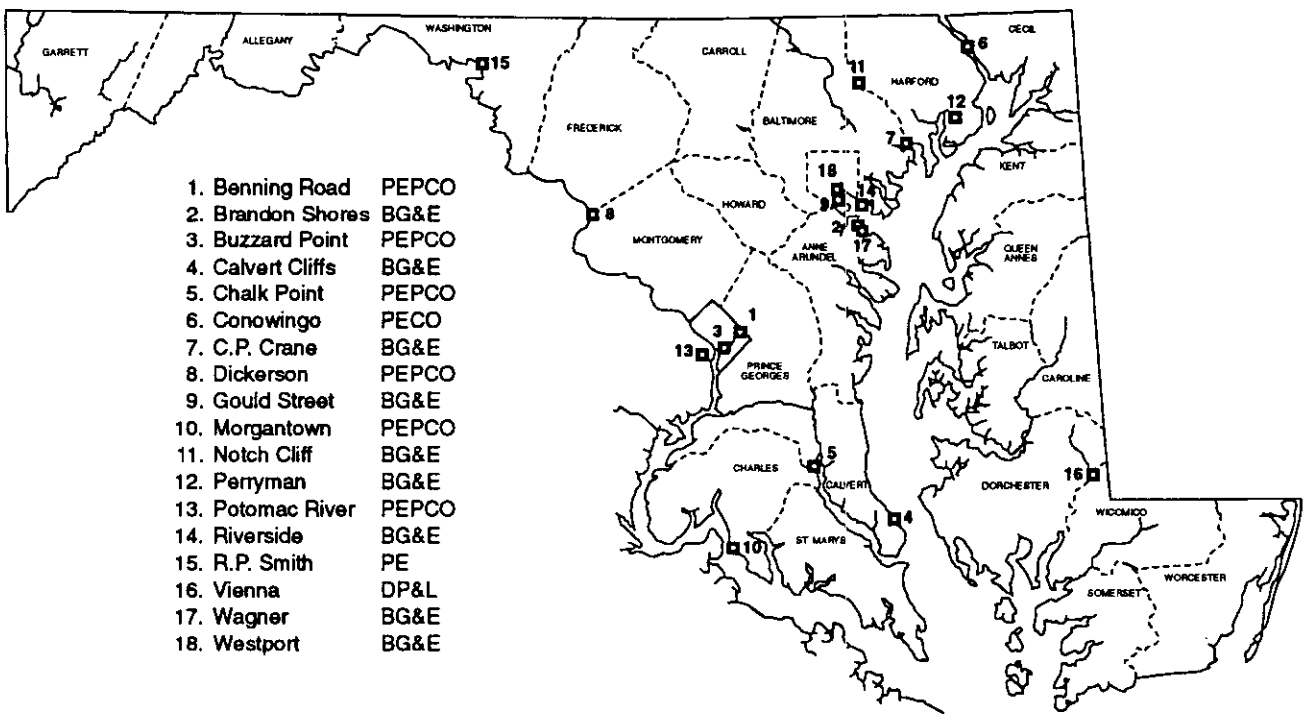
The amount of electricity generated by power plants in Maryland is not sufficient to meet the total power demands of the state's residents. Therefore, Maryland utilities import more than 30 percent of the state's electricity from power generating facilities in neighboring states. Most of these imports come from power plants owned by Maryland utilities but located in other states, and from long- and short-term power purchases from investor-owned utilities in other states. Because of the complex power distribution agreements in the region, some of the energy generated in Maryland is actually exported out of state. For example, although Maryland is a net importer of power, Maryland power plants serve the power demands of some customers in the District of Columbia.

The service areas of Maryland's electric utilities are shown in Figure 1-1; power plants in Maryland are shown in Figure 1-2.

Investor-owned Utilities (IOUs)

Seven IOUs operate in Maryland. Four of these are large integrated firms that generate, distribute, and sell electricity throughout the state:

Figure 1-2
Location of Power Plants In and Around Maryland
(with capacity greater than 90 MW)



- *Baltimore Gas & Electric Company (BG&E),*
- *Delmarva Power & Light Company (DP&L),*
- *Potomac Edison Company (PE), and*
- *Potomac Electric Power Company (PEPCO).*

A fifth utility, Conowingo Power Company, which obtains nearly all of its energy requirements from its parent company, Philadelphia Electric Company (PECO), primarily serves Cecil County in northeastern Maryland.

The sixth and seventh IOUs operate generating facilities in the state but sell no electricity in Maryland:

- *Susquehanna Power Company, a wholly owned subsidiary of PECO, operates the hydroelectric facility at Conowingo Dam; and*
- *Pennsylvania Electric Company operates a small hydroelectric facility near Deep Creek Lake in Garrett County.*

Baltimore Gas & Electric Company (BG&E)

BG&E is a combination gas and electric utility primarily serving the metropolitan Baltimore area. The electric department serves a 2,300-square-mile area with an estimated population of 2,500,000 and more than 550,000 customers. Large commercial and industrial customers account for 50 percent of total sales, residential 40 percent, and small commercial 10 percent of total sales. During 1991, BG&E's system peak demand for electricity from all of its customers was 5,910 megawatts (MW), while its power plants generated a maximum of 6,624 MW of electricity. The system peak demand is expected to grow to 6,110 MW by the year 2000, which will require BG&E to add about 600 MW of new capacity to meet rising demand while maintaining an adequate reserve margin. Generating capacity at two older power plants totaling 384 MW will be retired within the next three years.

In 1991, 45 percent of the electricity BG&E supplied to its customers was from nuclear energy, 30 percent from coal, 10 percent from oil and natural gas, and 15 percent from energy purchases. Of the generation required to meet BG&E's energy requirements, 28 percent was imported from resources outside of the state.

Delmarva Power & Light Company (DP&L)

DP&L is also a combination gas and electric utility providing electric service to the Delmarva Peninsula. This is an area covering 5,700 square miles with a population of 800,000, consisting of the entire state of Delaware, portions of Maryland's nine Eastern Shore counties, and the two Virginia Eastern Shore counties — Accomack and Northampton. Maryland accounts for about 20 percent of DP&L's total electric sales. In addition to retail sales, DP&L sells electricity at wholesale to a Maryland municipality and two rural cooperatives. DP&L provides most of the bulk power needs of the town of Berlin, the Choptank Electric Cooperative, and the A&N Electric Cooperative. In 1991, DP&L's annual company peak demand was 2,430 MW, while capacity resources totaled 2,648 MW. DP&L expects its company peak demand to grow to 2,929

MW by the year 2000, requiring about 650 MW of additional generating capacity. Most of DP&L's generating capacity is located in Delaware, including a major new unit currently under construction; the utility has also proposed a major coal-fired plant for operation in Dorchester County, Maryland.

Potomac Edison Company (PE)

PE, which serves customers in Maryland, Virginia, and West Virginia, is one of three operating utility subsidiaries of the Allegheny Power System (APS) utility holding company. PE serves 335,000 customers in a 7,193-square-mile service territory having a population of 730,000. During 1991, Maryland accounted for 67 percent of total PE sales. In Maryland, PE's customer base is heavily industrial, accounting for more than 45 percent of total sales. In addition, PE serves three Maryland municipalities at wholesale — the cities of Hagerstown, Thurmont, and Williamsport. The 1991 PE system peak demand was 1,915 MW; capacity resources for the APS system in 1991 were 7,941 MW.

Potomac Electric Power Company (PEPCO)

PEPCO provides service in the metropolitan Washington, D.C. area to more than 650,000 customers in a 640-square-mile area with a population of 1,900,000. This service area includes the District of Columbia and major portions of Prince Georges and Montgomery Counties in Maryland. PEPCO also sells electricity at wholesale to the Southern Maryland Electric Cooperative (SMECO), which serves an area of 1,150 square miles in Calvert, Charles, St. Mary's, and Prince Georges Counties in southern Maryland. PEPCO has few industrial customers. In addition to its residential customers, PEPCO serves a combination of commercial and government customers. In 1991, PEPCO's system peak demand was 5,769 MW and capacity resources totaled 6,285 MW.

Electric Generating Capacity of Maryland Utilities

At present, electric utilities operate a total 11,128 MW of generating capacity in Maryland, the vast majority of which is owned and operated by BG&E, DP&L, PE, and PEPCO. Table 1-1 lists the power plants in Maryland, existing generating capacities at each plant, and any planned capacity additions or reductions over the next several years. The table includes existing non-utility generator (NUG) plants whose total output is purchased by a utility, and proposed NUG facilities with long-term contracts that have been approved by the Maryland PSC.

Figure 1-3
Fuel Used to Generate Electricity in Maryland in 1991

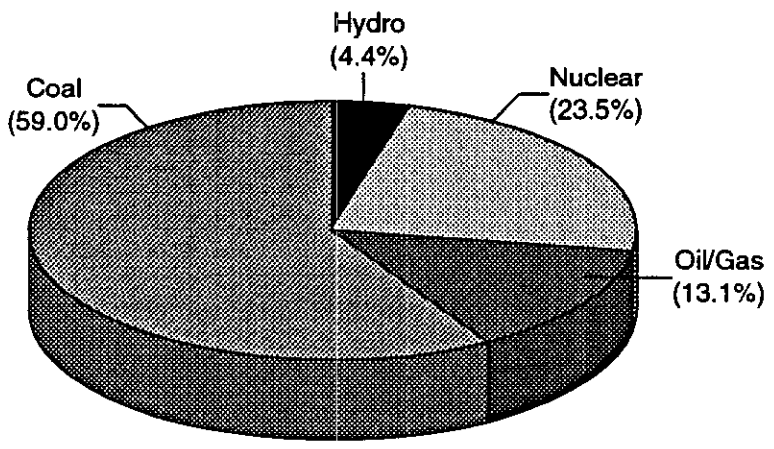


Table 1-1
Current and Planned Generating Capacity in Maryland

Utility	Plant Name	Major Fuel Type	Capacity (MW) Current	Planned
BG&E	Brandon Shores	Coal	1,284	—
	Calvert Cliffs	Nuclear	1,650	—
	C.P. Crane	Coal	390	—
	Gould Street	Oil	103	—
	Notch Cliff	Gas	128	—
	Perryman	Oil/Gas	208	440
	Riverside	Oil/Gas	450	(199)
	Wagner	Coal/Oil	1,003	—
	Westport	Oil	244	(126)
	Philadelphia Road	Oil	64	—
	Bethlehem Steel [1]	Gas	169	—
	BRESCO [1]	Waste	57	—
	Subtotal		**5,750**	**115**
PEPCO	Chalk Point	Coal/Gas	2,331	—
	Dickerson	Coal/Gas	694	407
	Morgantown	Coal	1,412	—
	SMECO[2]	Gas	84	—
	Montgomery County[3]	Waste	—	50
	Panda Brandywine [3]	Gas	—	230
	Subtotal		**4,521**	**687**
PECO (Susquehanna)	Conowingo	Hydro	512	—
Penelec	Deep Creek Lake	Hydro	20	—
APS/PE	R. P. Smith	Coal	114	—
	AES Warrior Run [3]	Coal	—	180
DP&L	Vienna	Oil	150	—
	Dorchester	Coal	—	300
	Crisfield	Oil	10	—
Easton	Easton	Oil	47	46
Berlin	Berlin	Oil	4	5
TOTAL			**11,128**	**1,333**

1 Non-utility generating plant.
2 The SMECO facility is located at the Chalk Point Station operated by PEPCO. PEPCO is entitled to the full output of the unit under a long-term contract.
3 Proposed non-utility generating plant.

The principal fuel burned at Maryland's power plants is coal, which in 1991 accounted for roughly 60 percent of the generation in Maryland (Figure 1-3). Nuclear, represented by BG&E's Calvert Cliffs plant, accounted for nearly 25 percent of total generation in 1991.

Publicly Owned Utilities

Two types of publicly or member-owned utilities operate in Maryland — municipal electric systems and rural electric cooperatives. Municipals include systems operated by the cities of Hagerstown, Thurmont, and Williamsport, which buy their electricity from PE; the town of Berlin, which buys its electricity from DP&L; and the town of Easton, which is interconnected to DP&L's system but has its own generating capacity. Rural electric cooperatives include SMECO; A&N and Choptank, which buy their power from DP&L; and Somerset, whose energy is supplied by the Allegheny Electric Cooperative in Pennsylvania. A&N and Somerset serve only a few Maryland customers and mostly operate in other states.

Non-utility Generators

A small but expanding portion of Maryland's electric power supply comes from NUGs — power generation facilities owned and operated either by major industrial firms or private third-party developers. The power from these projects is either consumed on-site (if, for example, the facility is located at an industrial plant) or sold wholesale to the local electric utility.

Non-utility generation has been slow to develop in Maryland compared with surrounding states and some other regions of the United States. Presently, there are approximately 300 MW of installed NUG capacity in Maryland from more than a dozen projects. However, nearly all of that 300 MW is from three large projects — 169 MW at Bethlehem Steel's Sparrows Point plant, 57 MW from the Baltimore Refuse Energy Systems Company (BRESCO) facility, and 50 MW from a power plant at the Westvaco paper plant in western Maryland. All others are very small and produce only modest amounts of energy.

There are several NUG projects in the planning stage in Maryland. Table 1-2 provides a list of all current and planned NUG facilities of 10 MW or more in Maryland with executed long-term sales contracts with local utilities. Several other major NUG projects have been proposed but have not obtained utility sales contracts. The Maryland PSC has approved three of the planned contracts listed in Table 1-2; contract approval for the AES Northside project is pending. The four planned projects total 760 MW, which represents a very large percentage of total planned capacity additions in Maryland over the next decade. PPRP is involved in evaluating the potential impacts associated with the three proposed cogeneration projects: AES Warrior Run, AES Northside, and Panda Brandywine. Maryland utilities have also entered into power purchase agreements with NUG projects located outside of Maryland.

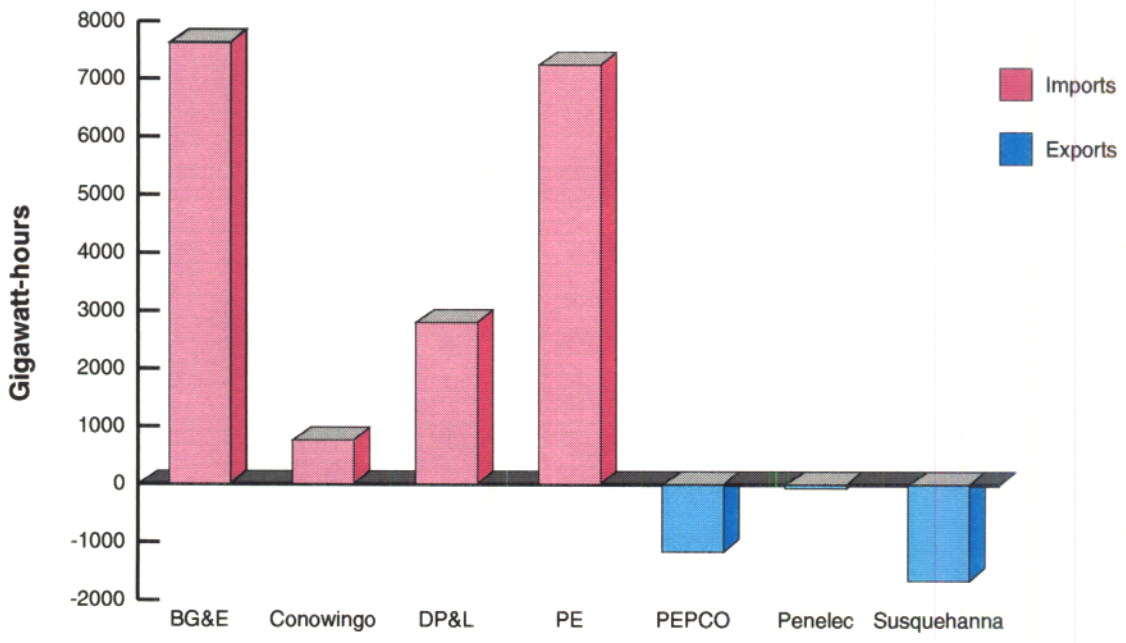
Table 1-2
Current and Planned NUG Facilities in Maryland (10 MW or Larger)

Facility	Location	Purchasing Utility	Type of Facility	Size (MW)	Projected On-Line
Current:					
BRESCO	Baltimore City	BG&E	Waste	57	Current
Bethlehem Steel	Sparrows Point	BG&E	Cogenerator	169	Current
Westvaco	Allegany County	Self/PE	Waste	50	Current
Amstar	Baltimore County	Self/BG&E	Cogenerator	10	Current
			Subtotal Current	286 MW	
Planned:					
AES Warrior Run	Allegany County	PE	Cogenerator	180	1995
Panda Brandywine	Prince Georges County	PEPCO	Cogenerator	230	1996
AES Northside	To be determined	BG&E	Cogenerator	300	1997-2001
Montgomery County	Dickerson	PEPCO	Waste	50	1996
			Subtotal Planned	760 MW	

Maryland as an Importer/Exporter of Electricity

Because electricity sales to Maryland customers are greater than the amount of electricity generated in the state, a substantial quantity of energy is imported from neighboring states. Three utilities — BG&E, DP&L, and PEPCO — import a considerable amount of energy from the Conemaugh and Keystone plants in western Pennsylvania (plants in which the three utilities hold partial ownership). DP&L also imports electricity from both the Peach Bottom nuclear power plant in southern Pennsylvania and the Salem nuclear plant in southern New Jersey. In addition, PEPCO and BG&E import substantial amounts of power from Ohio and Pennsylvania under long-term contracts. Maryland's status as a net importer of power is due principally to DP&L and PE. Both companies have substantial customer bases in Maryland but at present generate very little energy in Maryland. The amount of electricity imported to and exported from Maryland in 1991 is shown in Figure 1-4.

Figure 1-4
Maryland Energy Imports and Exports, 1991



Who Uses Electricity in Maryland?

Users of electricity in Maryland are generally classified as residential, commercial, industrial, or governmental. Overall, usage of electricity in Maryland is 60 percent non-residential and 40 percent residential, although each utility's customer base is different.

Most of Maryland's manufacturing industry is located in the service territories of BG&E and PE, so a higher proportion of these two utilities' sales are to industrial customers. In fact, most of the total sales for these two utilities are to the primary metals industry in Maryland, because PE provides service to Eastalco Aluminum Company and BG&E serves the Bethlehem Steel Company. Municipalities and rural cooperatives tend to sell a somewhat larger percentage of their total energy to households than do the larger investor-owned utilities.

Energy sales in Maryland are expected to continue growing, but at a slower rate than they have been recently. From 1981 to 1991, the annual rate of growth in energy sales in Maryland by DP&L, BG&E, PE, and PEPCO (the four utilities accounting for more than 92 percent of all energy sales in the state) ranged from 2.4 percent to 4.6 percent, averaging 3.7 percent. Over the ten years from 1991 to 2001, the annual rate of growth in energy sales is projected to range from 1.6 to 2.2 percent, averaging 2.0 percent.

The factors most significantly affecting electricity demand in Maryland include growth in population, income, and employment; the price of electricity; and the energy efficiencies of electricity-using equipment. In addition to these factors, the mix of business activities in the state also affects electricity demand. The large gains in population, income, and employment experienced in much of the state during the decade of the 1980s will likely not be repeated in the 1990s. Furthermore, the general decrease in real (inflation-adjusted) electricity prices that occurred in the 1980s will probably be replaced by stable or moderately increasing electricity prices due to new construction by the utilities, impacts of the 1990 Clean Air Act Amendments, and anticipated increases in fuel prices. Maryland, like the United States as a whole, is shifting to a more service-oriented economy, which tends to use less energy than heavy manufacturing on a per-worker basis. These factors, taken together, are largely responsible for the slower rates of growth in electricity demand expected over the coming decade.

In addition, utility-sponsored conservation efforts have recently emerged as a major new factor that will slow the growth of energy usage in the 1990s. These efforts are discussed in more detail in Section 4.

Power Pooling

To gain the efficiency and reliability benefits of interstate and intrastate power transactions, the Maryland utilities participate in multi-utility **power pools**. PE and its two utility affiliates form the **APS Power Pool**. PEPCO, BG&E, and DP&L are members of the **Pennsylvania-New Jersey-Maryland Interconnection (PJM) Power Pool,** which also includes most of the electric utilities in Pennsylvania, New Jersey, and Delaware.

The PJM pool employs an operating procedure known as **economic dispatch** to minimize fuel costs for all members. With economic dispatch, a utility system makes maximum use of its lowest-operating-cost generating units (coal and nuclear plants) and only uses more expensive units (oil- or gas-fired units) when the lower cost units are already running at their maximum levels. PJM implements this process by collecting plant operating data on all member plants and continuously determining the pool-wide cost of generating an additional kilowatt-hour (the incremental cost). It operates all of the members' units as a single system, in which generation is added from the most economical source available — regardless of ownership — to meet the next increment of load. These intercompany power transactions are referred to as **interchanges**. Through this system of economic dispatch, PJM gains cost savings and distributes those savings among its members.